

FORM PTO-1300 (Modified)
(REV 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES

32643.0293

DESIGNATED/ELECTED OFFICE (DO/EO/US)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.55)

CONCERNING A FILING UNDER 35 U.S.C. 371

09/647120

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/US99/06126

26 March 1999

27 March 1998

TITLE OF INVENTION

METHODS AND APPARATUS FOR NETWORK APPLICATIONS USING OBJECT TOOLS

APPLICANT(S) FOR DO/EO/US

AANNESTAD, Bjorn

STACK, John

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). (Unsigned)
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Copy of Reply to Written Opinion filed in PCT/US99/06126

Receipt Post Card

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.5) 09/647120	INTERNATIONAL APPLICATION NO. PCT/US99/06126	ATTORNEY'S DOCKET NUMBER 32643.0293
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21. The following fees are submitted. BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$970.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$840.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$690.00 <input checked="" type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$670.00 <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$96.00	CALCULATIONS PTO USE ONLY																									
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Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)). <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30	\$130.00																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%;">CLAIMS</th> <th style="width: 20%;">NUMBER FILED</th> <th style="width: 20%;">NUMBER EXTRA</th> <th style="width: 20%;">RATE</th> <th style="width: 20%;"></th> </tr> <tr> <td>Total claims</td> <td>16 - 20 =</td> <td>0</td> <td>x \$18.00</td> <td style="text-align: center;">\$0.00</td> </tr> <tr> <td>Independent claims</td> <td>2 - 3 =</td> <td>0</td> <td>x \$78.00</td> <td style="text-align: center;">\$0.00</td> </tr> <tr> <td colspan="4">Multiple Dependent Claims (check if applicable). <input type="checkbox"/></td> <td style="text-align: center;">\$0.00</td> </tr> <tr> <td colspan="4" style="text-align: center;">TOTAL OF ABOVE CALCULATIONS =</td> <td style="text-align: center;">\$800.00</td> </tr> </table>	CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		Total claims	16 - 20 =	0	x \$18.00	\$0.00	Independent claims	2 - 3 =	0	x \$78.00	\$0.00	Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	TOTAL OF ABOVE CALCULATIONS =				\$800.00	
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Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). <input checked="" type="checkbox"/>	\$400.00																									
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Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>	\$0.00																									
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- ☐ A check in the amount of _____ to cover the above fees is enclosed.
- ☒ Please charge my Deposit Account No. **19-2814** in the amount of **\$400.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.
- ☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-2814** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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 SIGNATURE

Daniel R. Pote

NAME

43,011

REGISTRATION NUMBER

26 September 2000

DATE

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9(f) AND 1.27 (e)) - SMALL BUSINESS CONCERN**

 Pocket No.
32643.0293

Serial No.

Filing Date

Patent No.

Issue Date

Applicant/

Patentee: **Aannestad, Bjorn, et al.**Invention: **METHODS AND APPARATUS FOR NETWORK APPLICATIONS USING OBJECT TOOLS**

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
- ☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: **Infomage, Inc.**ADDRESS OF CONCERN: **100 West Clarendon, Suite 2300, Phoenix, Arizona 85013**

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☐ the specification filed herewith with title as listed above.
- ☒ the application identified above.
- ☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.
☐ each such person, concern or organization is listed below.

FULL NAME
ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME
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☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

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☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING:

Randall W. Eckel

TITLE OF PERSON SIGNING

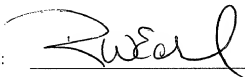
OTHER THAN OWNER:

President

ADDRESS OF PERSON SIGNING:

InfoImage, Inc.
100 West Clarendon, Suite 2300
Phoenix, Arizona 85013

SIGNATURE:



DATE: October 8, 2000

METHODS AND APPARATUS FOR NETWORK APPLICATIONSUSING OBJECT TOOLS

CROSS-REFERENCES TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No.

5 60/079,611, filed March 27, 1998, hereby incorporated by reference.

TECHNICAL FIELD

The present invention relates, generally, to network groupware applications and, more particularly, to methods and apparatus for developing object-oriented systems in the context of non-object-oriented application environments.

BACKGROUND ART AND TECHNICAL PROBLEMS

10 Object oriented programming is a formal programming practice characterized by, among other things, encapsulation, inheritance, and object polymorphism. Due in part to the advantages of these characteristics, object oriented programming has quickly become the preferred software development paradigm. Notwithstanding this
15 trend, modern enterprise groupware database systems remain tied, on the development level, to traditional programming techniques. Such systems, while powerful, are substantially aimed at providing ease of use for end-users, and therefore rely almost exclusively on simple graphical programming methods and flat-file functionality. Example enterprise groupware environments include, for example, the
20 Lotus Notes application environment as described in the relevant system documentation, e.g., LOTUS NOTES RELEASE 4 APPLICATION DEVELOPER'S GUIDE (1995), hereby incorporated by reference.

The lack of modular and object oriented design standards in known groupware database applications gives rise to a number of problems. For example, application
25 development time is often unnecessarily prolonged due to a lack of code reuse. That is, programming efficiency is decreased when custom modules must be created for a given application. In addition, it is often difficult to customize a particular section of code when such customization is desired. That is, because of the inherent non-

modularity of typical enterprise groupware environments, altering one segment of code can unexpectedly impact on other sections of code in undesirable ways.

Furthermore, programmers are not always disciplined with respect to naming standards for forms, views, fields, variables, and the like. As a result, other
5 programmers (indeed, even the same programmer) may be confronted by names which are inconsistent and fail to describe the role of the particular component. This tends to increase development time, generate bugs, and frustrate code maintenance. Moreover, such inconsistencies tend to reduce code-sharing as it is often difficult for one programmer to understand, adapt, and maintain the code written by another.

10 When clear software standards are not employed, quality control is very difficult to implement. Moreover, such coding tends to be inconsistent across application, resulting in variation in user interfaces experienced by the end user. Even when clear standards exist, it is extremely difficult and time-consuming to manually search through code to locate inconsistencies and bugs.

15 Methods and apparatus are therefore needed to overcome these and other limitations in the prior art.

SUMMARY OF THE INVENTION

The present invention provides methods and apparatus for developing object-oriented network groupware applications in substantially non object-oriented
20 programming environments. Object-oriented architectural and naming standards are used in conjunction with object repositories, an application builder, an application analyzer, a code fragment library, and development standards in order to create modular code, thereby addressing limitations of the prior art.

In accordance with one aspect of the present invention, a method for using a
25 programmable digital computer to create object-oriented applications within a non-object-oriented software environment includes the steps of: creating, in accordance with a predetermined set of design standards, an object within said non object-oriented software environment, wherein: said object comprises at least one of said design elements; said object is characterized by inbound public interfaces, outbound
30 interfaces, and dependencies implemented using said design elements; transferring

said object to said application; and determining, for said object, a level of compliance to said predetermined set of design standards.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

The subject invention will hereinafter be described in conjunction with the
5 appended drawing figures, wherein like numerals denote like elements, and:

Figure 1 shows a diagrammatic block diagram of an exemplary object tools system;

Figure 2 shows a conceptual model of an exemplary object useful in illustrating the present invention;

10 **Figure 3** is a flowchart depicting an exemplary application development process;

Figure 4 shows a diagrammatic block diagram of an exemplary network environment;

Figure 5 shows an exemplary application builder main menu;

Figure 6 shows an exemplary menu for use in an "add objects" function;

15 **Figure 7** shows an exemplary menu for use with a "remove objects" function;

Figure 8 shows an exemplary menu for use with an "import new objects" function;

Figure 9 shows an exemplary menu used to invoke an Application Analyzer in accordance with the present invention;

20 **Figure 10** presents a general guide to object model diagrams; and

Figure 11 shows an object model diagram corresponding to an exemplary architectural standard.

DETAILED DESCRIPTION OF PREFERRED EXEMPLARY EMBODIMENTS

25 A system in accordance with various aspects of the present invention includes methods and apparatus for developing object-oriented network groupware applications in substantially non object-oriented programming environments. With reference to **Figure 1**, an exemplary object tools system 100 includes Carrier Databases 102, Object Repositories 104, Application Builder 106, Code Fragment
30 Library 110, Application Analyzer 114, and Analysis Template 112. All or some of

these components may be employed in creating the individual software applications 108. In addition, an exemplary embodiment might include various tutorial and reference materials, e.g., user guide 118, example databases 120, and walk-through databases 122. An auxiliary file database may also be provided for storing ancillary 5 files used by various objects, for example, graphic files, Java applets, and the like. It will be appreciated that **Figure 1** presents a conceptual, diagrammatic overview of an exemplary object tools system in accordance with the present invention, and that suitable hardware and software components (e.g., servers, routers, data links, user computers, and the like) would be employed in order to implement the present system 10 in a network environment. The specific geometry, topology, and labels used in **Figure 1** are not intended to limit the scope of the present invention.

Referring now to **Figure 4**, the present system is suitably implemented in a distributed enterprise environment comprising one or more servers 402, one or more developer workstations 405, and one or more user workstations 404 connected using 15 appropriate data links 410 over a conventional network 408. The various objects and applications might be located within servers 402, user workstations 404, or a combination of both. Software development preferably takes place on developer workstations 406, but may alternatively take place at any other suitably configured workstation (e.g., servers 402 or user workstations 404). Servers 402 and user 20 workstations 404 may comprise any suitable hardware/software configuration, for example, any of the various Intel Pentium-based computers or equivalents running in a Windows NT or Windows 95 environment, or various Sun Microsystem workstations running in a Solaris environment. In a preferred embodiment, developer workstations comprise a 32 bit Windows NT or Windows 95 workstation.

Referring again to **Figure 1**, Carrier Databases 102 provide a mechanism 25 through which the various objects may be distributed to end-users via e-mail, the Internet, or any other conventional data communication network. Carrier Databases 102 allow objects to be shared between users and provide a efficient means for developers to distribute updated objects to users utilizing those objects in their 30 applications.

Object Repositories 104 are preferably used to store the various design elements that comprise the objects used to build individual applications 108. User's may create their own Object Repositories 104, and common repositories may be provided, for example, as a location for archiving old and outdated objects.

5 Application Builder 106 assists the developer in transferring objects within the system, and acts as an interface to Application Analyzer 114 and various standards and preferences related thereto. In an exemplary embodiment, Application Builder 106 allows transfer of objects to and from Object Repositories 104, applications 108, and Carrier Databases 102. This allows the developer to easily add or remove objects
10 from an application in a robust manner -- i.e., in a way that is not likely to generate unexpected software bugs.

Code Fragment Library 110 comprises small pieces of reusable code -- preferably designed in accordance with standards set forth in greater detail below -- which are typically not themselves complete functions or subroutines, but which can
15 easily be copied into objects during application development.

Application Analyzer 114 is preferably used to analyze individual or groups of applications 108 as well as the various objects that comprise those applications. In a preferred embodiment, Application Analyzer 114 creates a Result Document 116 for each design element and object used in an application 108 and sorts these result
20 Documents 116 into predefined categories for further analysis. Application Analyzer 114 may also be used to identify any deviations from the preferred architectural and naming standards, thereby promoting standards compliance. In this way, Application Analyzer 114 facilitates efficient quality control, debugging, and preparation of documentation for applications 108. Documents 116 are preferably created in
25 accordance with Analysis Template 112, which specifies a format for the various reports included in Result Documents 116.

Objects

Before discussing the various system components in detail, it is necessary to define the term "object" as used in the context of the present invention. As noted
30 above, it is common for database environments -- for example, Lotus Notes -- to

provide user interfaces which are end-user-friendly, but which are not object-oriented, and therefore suffer from a number of development limitations as described above in the Background section. The present system utilizes the underlying elements of the database environment, but imposes upon them and profits from an object-oriented
5 framework.

Object-oriented frameworks offer a number of advantages.

Having thus given a general overview of object-oriented programming, a method for employing object-oriented techniques in the context of the present invention will now be described. In the discussion that follows, the terminology
10 popularized by Lotus Notes will be used throughout. Those skilled in the art, however, will appreciate that the present invention may be deployed in other database environments. For example, the meaning of "object" should not be construed to include only conventional Lotus Notes elements. Other object types (Dynamic HTML, APIs, query layouts, etc.) may also be employed.

15 Referring now to **Figure 2**, in accordance with one embodiment of the present invention, an object may comprise any combination of forms 202, subforms 208, views 204, agents 206, navigators 210, and fields 212. An object may also comprise groups, roles, script subroutines or class definitions, graphics, or portable code files (not shown in **Figure 2**).

20 Briefly, a form is a template, or window, through which the user may view database information. Forms, which are roughly analogous screen layouts, present data in a number of fields in a manner specified by the application developer.

A subform is a type of form containing fields configured in an often-used layout (for example, header information, navigation bars, and the like).

25 A view is used to display database information in row and column format in order to assist the user in finding the desired information. A view may include data extracted from fields, results, or computation fields. A navigator may also be used to provide graphical assistance in finding data.

30 A field contains a particular type of information, for example, text, rich-text, word lists, numbers, times, dates, user names, etc. In a typical application, a form presented to the user includes a number of fields, some of which are configured to

receive user input, and some of which are constant or a function of other fields or data. In addition, appropriate security conditions may be associated with a given field, sets of fields, documents, databases, applications, or data records.

5 An agent is a component that automates certain functions within an application. For example, an agent may be employed to notify users of an impending due date, perform database maintenance, or perform various types data manipulation.

Further information regarding these and other exemplary object elements may be found in a number of texts, for example, the Lotus Notes 4 Application Developer Guide referenced above.

10 Given the exemplary set of object elements described above, the manner in which these elements may be employed in an object oriented environment will now be outlined.

An important aspect of object-oriented systems is the distinction between private and public elements. An object is, by definition, functionally abstract --
15 meaning that while its functions and public interfaces are quite clear in usage, its internal workings are not necessarily clear or even known to the user. In the present invention, design elements (forms, views, etc.) may be designated as public or private, and fields themselves may also be public or private. That is, certain forms, views, subforms, agents, and navigators may be used by the object itself, or may be
20 used by other objects as well. Similarly, certain fields may be public (referred to as "out-bound public interfaces") or private (in which case they must not be referred to by any other object). For example, in **Figure 2**, field 212(a) is illustrated as public, while field 212(b) is illustrated as private.

In the context of the present invention, objects receive input through fields,
25 referred to as "in-bound public interfaces." These fields are created and maintained in the referring code, not the object itself. For example, field 212(a) shown in **Figure 2** may be an out-bound public interface to another object which uses the value of field 212(a) as an in-bound public interface to an internal algorithm.

Objects may also receive inputs from documents, i.e., they may retrieve input from
30 data stored elsewhere in the database.

In accordance with a the present methodology, an object should not be thought of as simply a field, or an agent, or as any particular element. Instead, an object is a function or component whose behavior and implementation is defined as a collection of design elements and properties. This provides a mechanism which makes it easy to define complex objects that are not pure instances of one element. A particular object might exist in only one part of the environment, or it might extend into several parts of the environment. For example, a basic field object might only exist in the field and form parts of the environment, whereas a object free-time search algorithm would probably involve fields, views, agents, buttons, and layout regions.

Interfaces are essentially any location that you can put code in the underlying groupware application, for example, events, view selection formulas, agents, script subroutines, navigators, icons, properties, screen "hot-spots," and the like.

Development Process

Having thus given a general overview of objects as well as various components comprising an exemplary object tools system 100, an overview of an exemplary development process in accordance with various aspects of the present invention will now be described.

Referring now to **Figure 3**, a developer typically begins a design session in one of three ways. First, a developer may utilize a Carrier Database 102 to share preexisting objects with another Developer (Step 304). Alternatively, the developer may proceed directly to invoking Application Builder 106 (Step 310), or may modify or debug a pre-existing object (Step 308).

In Step 304, one or more Carrier Databases 102 are preferably utilized as a vehicle for assembling new or modified objects prior to inclusion in an Object Repository 104. Carrier Databases 102 are preferably created from a carrier database template residing in a suitable location within the system. The developer preferably populates the Object Repository 104 with at least the following items: 1) design elements used by the object, 2) documentation for the object, and 3) an object map document (listing object names, object IDs, design elements, interfaces, and the like).

In Step 308, the developer assembles and configures the various forms, subforms, views, agents, navigators, and fields that are required for a particular application. These design elements are preferably created, named, and configured in accordance with architectural and naming standards described in detail below.

5 In Step 310, the developer invokes Application Builder 106. As mentioned briefly above, Application Builder 106 supports modularity by assisting the developer in transferring objects in a robust manner. In addition, Application Builder 106 acts as an interface to Application Analyzer 114 and Code Fragment Library 110 and can be used to define other interfaces created by the developer. In an exemplary
10 embodiment, Application Builder 106 allows transfer of objects to and from Object Repositories 104, applications 108, and Carrier Databases 102. Specifically, when the developer initiates Application Builder 106, the system presents a suitable graphical interface for selecting from a plurality of functions. In an exemplary embodiment, a main menu screen such as that shown in **Figure 5** is displayed,
15 offering at least four choices: add objects 502, remove objects 504, import objects 506, and run Application Analyzer 508. If the developer selects the "add objects" function (502), a second, more detailed input screen is displayed, for example, an input screen as shown in **Figure 6**. Here, the developer selects the appropriate application to which the objects will be added (602), selects the objects to be added
20 (604), and implements the addition with certain options (606). In this way, the developer is able to transfer objects from various Object Repositories to the application of interest (items 104 and 108 in **Figure 1** respectively).

Referring again to **Figure 5**, "remove objects" function 504 allows the developer to remove unwanted or unneeded objects from an application. A variety of
25 interfaces to this function may be appropriate -- for example, an interface as shown in **Figure 7**. More particularly, in the illustrated embodiment, one or more menu screens suitably provide an input region 702 for selecting an application from which objects are to be removed, an input region 704 for selecting objects to removed, a region 706 for activating the remove function, and an input region 708 for reviewing
30 a log of past removal operations.

"Import objects" function 506 suitably allows the developer to move an objects design elements, documentation, and object map from a Carrier Database 102 to an Object Repository 104. A variety of user interfaces may be employed to carry out this function. In an illustrated embodiment, one or more menu screens provide a region 5 802 for selecting an Object Carrier from which objects will be imported, a region 804 for selecting a Repository to which objects will be transferred, a region 806 for specifying the location of the applicable user guide (i.e., documentation such as object models, required elements, and the like), a region 808 for choosing object types (i.e., subsets of available objects), a region 810 for activating the import 10 function, and an input region 812 for reviewing the log.

Application Builder 108 also suitably provides an option for accessing the Code Fragment Library 110 (function 510). It will be appreciated that the various functions presented by the illustrated Application Builder 106 may alternatively be distributed between multiple software programs using any number of different user interfaces.

15 In cases where objects are added to an application, the developer may be required -- in accordance with certain architectural standards as detailed below -- to modify or add objects, fields, forms, or other design elements. Such required modifications are specified in the documentation via an object map associated with a given object. More particularly, documentation associated with each existing object 20 preferably sets forth a list of objects comprising that object, and specifies the required and optional inputs for each form. These inputs, or inbound public interfaces, are then supplied by the developer within the object or form being created. The documentation further specifies any dependent objects which must be copied (using Application Builder 106) and suitably configured.

25 "Run application analyzer" function 508 suitably invokes the Application. (Step 312). As mentioned briefly above, Application Analyzer 114 is preferably used to analyze individual or groups of applications 108 as well as the various objects that comprise those applications. In a preferred embodiment, Application Analyzer 114 creates a result document 116 for each design element and object used in an 30 application 108 and sorts these documents 116 into predefined categories for further analysis. Application Analyzer 114 is also used to identify any deviations from the

preferred architectural and naming standards set forth below, thereby promoting standards compliance. In addition, Application Analyzer 114 may be used to incorporate various standards developed within an end-user's organization, assess an application's Year-2000 compliance, and/or search for non-applicable or obsolete

5 functions or code.

In an exemplary embodiment, Application Analyzer 114 is invoked through Application Builder 106, for example, as shown in **Figure 5**, where function 508 provides an entry point into the analyzer. Running Application Analyzer 114 (Step 312) involves selecting an application to analyze (through selection of the appropriate
10 server and file path name), selecting an analysis file to which the results will be posted, then selecting various options as desired (for example, choosing whether incremental analysis should be performed and whether the objects themselves should be checked). More particularly, an illustrated embodiment employs one or more menu screens as shown in **Figure 9** wherein the user/developer is presented with an input
15 region 902 for selecting the application, input region 904 for selecting an analysis file, and a region 906 for invoking the analyze function.

When the analysis is complete, Application Analyzer 114 preferably creates a Result Document 116 for developer review which lists various data helpful in debugging and documenting the application in question (Step 314). Specifically,
20 Application Analyzer 114 preferably lists the various inspected objects along with any naming or architectural standards that have been violated.

After reviewing the results of the Application Analyzer, the developer may choose to debug the application under development to reconcile any deviations from the architectural or naming standards (Step 316). Thus, the developer may choose
25 to return to the Step 302 (or, most likely, Step 306) to continue refining and developing the application or various objects within the application.

Standards

As mentioned above, one aspect of the present invention relates to an advantageous set of standards imposed on object development which are "enforced"
30 via Application Analyzer 114. These standards are aimed primarily at producing

readable code, facilitating easy debugging, encouraging code reuse, and enhancing modularity. In general, standards used in the context of the present invention can be categorized as either naming standards or architecture standards.

- Naming standards involve rules used in conjunction with design elements
- 5 (forms, views, etc.) which are intended to incorporate into the element's name some indication of the purpose and/or source of the element. Architecture standards relate to, among other things, framework or "kernel" objects and design elements which are required in all or most applications. In addition to naming standards and architectural standards, certain visual standards related to text and graphics layouts may also be
- 10 desirable.

With respect to naming standards, each object is preferably named in such a way as to affect the various goals of the present invention. In a preferred embodiment, the object name is constructed as:

- <element prefix> <object ID> - <element name>, or
- 15 <element prefix> <object ID> <instance number> <element name> ,
- wherein the size and description of each component is specified in Table 1 below.

Component	Number of Characters	Description
< element prefix >	Two or Three	Describes what the element is and how it is used. Most types of design elements have several possible prefixes.
< object ID >	Six (with leading zeros and trailing x's if needed)	A unique ID that is assigned to the object for identification purposes. All design elements that are part of the same object have the same object ID in their names. This enables programmers and automated tools to easily determine the object to which a design element belongs.
Hyphen or < instance number >	One	<p>A hyphen is used mainly for visual distinction between the prefix and the descriptive part of the name, making it easier to read a list of design element names.</p> <p>An "instance number" is used when multiple copies of an element in one database are needed. For example, there may be a need for two subforms which are substantially identical and serve the same purpose but must have different names so that they may be used together on the same form.</p> <p>The instance number is preferably a single digit, 0 through 9. If more than 10 instance numbers are needed, lowercase alphabetic characters should be used.</p>
< element name >	Variable	<p>Descriptive name for the design element which identifies what the element is used for.</p> <p>Mixed case with the first letter of each distinct word capitalized. May include valid punctuation characters, but no spaces, avoiding certain symbols and punctuation characters (e.g., " \", "#", "@", and "**") which may cause problems for Web clients.</p>

TABLE 1

Object prefixes are preferably specified for each class and type of design elements. In the case of view elements, prefixes are suitably chosen in accordance with Table 2 below.

Prefix	Comment
cal	A calendar view, visible to the user.
db	A view used internally by the application for lookups or other processing. Not visible to the user.
fol	A folder, visible to the user.
vdb	A view used internally and also seen by users (such as views used in pick-lists).
vv	Views visible to the user. Not used for any other purpose, such as lookups, iterating through a set of documents, etc.

TABLE 2

For example, the name "dbAC0012-PartNumberLookup" may be used in conjunction an internal look-up table view specifying a list of part numbers.

10 It may be desirable to create separate hidden views for users and for any internal processing views performed by an application, making it more convenient to alter the design of elements apparent to the user without affecting the code, thereby reducing the possibility of introducing errors. The "vv"/"cal"/"fol" and "db" prefixes are designed to make this distinction clear.

15 For visible views (i.e., views which appear on the View menu or the View/Folders pane) the IOT name is preferably used as the view's alias, as in "All Parts\By Size | vvAC0012-AllPartsBySize".

In a preferred embodiment, element prefixes for forms are selected in accordance with Table 3 below.

Prefix	Comment
doc	Regular document form
res	Response form
rtr	Response-to-response form
dlg	Document form used for a dialog box
ntp	Form used for a navigator template
nav (obsolete)	
vtp	Form used for a view template
vsr	Form used for a Search Results Template

TABLE 3

For forms whose names will not appear on the "Create" menu, object names with no aliases are preferably used (e.g., "res000000-CustomerComment"). For forms whose name will appear on the "Create" menu, the format "Create Customer Comment | res000000-CustomerComment" is preferably used. If in the context of a specific enterprise software system an alias is required (as might be the case with Notes or Domino), the alias is preferably placed to the right of the object name, for example: "ntpAC0012-StandardWebUI | \$\$NavigatorTemplateDefault."

In a preferred embodiment, element prefixes for subforms are selected in accordance with Table 4 below.

Prefix	Comment
sub	Regular subform

TABLE 4

For subforms, aliases are not needed, and only the object name need be used (for example: "sub0034xx-StandardDocumentHeader").

Script Libraries preferably employ a single element prefix as specified in Table 5 below.

Prefix	Comment
scl	A script library

TABLE 5

As with subforms, script libraries do not require aliases. For script libraries that contain a single class definition (with or without derived classes), the convention of naming the library with "class" plus the class name is preferably used.

Navigators preferably use a single element prefix as specified in Table 6 below.

Prefix	Comment
nav	A navigator

TABLE 6

There are preferably two types of navigator naming schemes -- one for navigators that will appear on the View\Show menu, and one that will not. For navigators whose names will appear on the View\Show menu, an alias is preferably used, for example, "End User Menu | navAC8020-EndUserMenu". For navigator names that will not appear on the View\Show menu, the object name within parenthesis is preferably used, as in "(navAC0820-ConfigMenu)".

In an illustrated embodiment, a more complex prefix scheme is used for agents since each one of the three characters in an agent prefix has a distinct meaning. More particularly, the first character identifies how the agent is triggered; the second character identifies how often the agent should run if it is a scheduled agent; and the third character identifies the documents to be processed (i.e., the "run on" setting).

Preferred characters for the first, second, and third places of the agent prefix are specified in Tables 7, 8, and 9 respectively.

First Prefix Character	How the Agent is Triggered
s	Scheduled background agent
t	Action menu or @Command([ToolsRunMacro]..)
a	Called by another agent
m	When documents are mailed to the database/new mail
p	When documents are pasted
v	Domino QuerySave agent
o	Domino QueryOpen agent

TABLE 7

Second Prefix Character	How the Agent is Scheduled
x	Placeholder if the agent is not a scheduled agent
h	Scheduled agent runs hourly
d	Scheduled agent runs daily
w	Scheduled agent runs weekly
m	Scheduled agent runs monthly
0	Scheduled agent runs every half hour
1	Scheduled agent runs every hour
2	Scheduled agent runs every two hours
4	Scheduled agent runs every four hours
8	Scheduled agent runs every eight hours

TABLE 8

Third Prefix Character	Type of Document Agent Runs On
a	All documents in the database
m	Runs on newly mailed documents
n	New and modified documents (i.e., the agent's unread marks)
p	Runs on pasted documents
u	Unread documents (i.e., the user's unread marks)
v	All documents in the view
s	Selected documents
r	Run once

TABLE 9

If the agent is specified to run at a fixed frequency, the digits 0-8 are preferably used for the second character. However, if the agent can be set by the user to run at a different frequency, the letter "h" ("hourly") is preferably used. For scheduled agents, the letters preferably "a" and "n" are used for the third character of the prefix.

Agent aliases can be complex, particularly in the context of Notes, since Notes itself will modify the agent name when the agent is set to "Run From Agent List." For agents whose names will appear on the Actions menu, an alias format such as "Process Sales Leads | txsAC8020-ExportLeads" is preferably used. For agents whose names are to appear on the View\Show menu, the object name is preferably used within parenthesis, for example: "(txrAC0820-ConfirmationPrompt)".

An alternate way to hide an agent is to set its run option to "Manually From Agent List." Notes will modify the names of such agents to include the parenthesis automatically. Aliases should not be used when naming these agents, as they are not necessary: the IOT name alone is preferably used.

In the illustrated embodiment, Object IDs are specified as comprising exactly six characters, wherein a character may consist of a letter (upper case or lower case) and some symbols. For readability purposes, it is advantageous to limit characters to upper case letters and numbers, using lower-case "x"s as place-holders where necessary (for example, "0123xx", "TESTxx", etc.) In this regard, Table 10 sets forth a preferred object ID naming scheme, where "?" denotes any alphanumeric

character.

ID	Description
000000	An all-zero object ID indicates a design element that is not associated with a reusable object. These are most commonly used for elements that are specific to an application.
5 0001?? through 9999??	Object IDs that begin with four numeric characters may be reserved for use by the development software and other products
10 A????? through Z?????	Object IDs in this range are available for developers to assign to objects in custom repositories. For example, if the developer's corporate initials are "AC" the developer might assign IDs in the sequence "AC0001" through "AC9999" to be custom objects.
TEMP?? DEMO?? TEST??	Object IDs that begin with these characters are used for elements that are not intended to become part of a finished application or object. The Application Analyzer preferably warns the developer when it comes across such an ID.

TABLE 10

A Notes field name is constructed as:

15 <purpose> <list> <datatype prefix>_{object ID}<field name>, or
<purpose> <list> <datatype prefix> <instance number>{object ID}<field name>.

Table 11 below sets forth a description of each of these components in accordance with a preferred embodiment of the present invention.

Component	Number of characters	Description
<purpose>	Zero or One	Indicates whether the field is used in any special context, such as a local variable. There are only a few cases where the purpose character is used.
<list>	Zero or One	A lower case "l" for fields that can contain multiple values.
<datatype prefix>	One to Four	Indicates the data type stored in the field. This tag covers all the Notes field data types (Text, Number, Rich Text, etc.) and also includes some additional ones where more detail is needed.
Underscore or <instance number>	One	<p>The hyphen is used mainly for visual distinction between the prefix and the descriptive part of the name, making it easier to read field names.</p> <p>An instance number is used when there is a need to have multiple copies of a field in a database. For example, there may be a need for two computed-for-display fields to display the same information in multiple places. One might be named "dtx1PhoneNumber," the other "dtx2PhoneNumber," making it clear that they are intended to show the same information.</p> <p>The instance number must be a single digit, 0 through 9. If more than 10 instance number are required, lowercase alphabetic characters may be used.</p>
{object ID}	Zero or Six	Optional component: used only when there is a chance that a field name in one object will duplicate one in another object. Note that if descriptive field names are chosen, the chances of name-collision are minimal.
<field name>	Variable, up to the limit for field names	Indicates the purpose or content of the field. A descriptive, self-documenting name is preferably used. The convention is to use mixed-case, and to capitalize the initial letter of each word. Spaces, punctuation, and most symbols are preferably not used.

TABLE 11

It should be appreciated that, for CGI surrogate variables (i.e., variables using the prefix "HTTP_"), capital letters should be used in order to duplicate the precise name

of the CGI variable. Examples field names in accordance with the above scheme include: "txt_OriginalAuthor" for a regular text field; "num_ACME54CurrentPrice" for a numeric field belonging to Acme object 54; and "dlnam_StateApprovers" for a multi-value, computed-for-display name field.

- 5 As mentioned briefly above, the first component for a field name is the Purpose identifier. In a preferred embodiment, purpose identifiers conform to the standards set forth in **Table 12** below.

Purpose Identifier	Comment
d	Field is computed-for-display
v	Local variable that is used internally in a formula, and does not correspond to a field
k	Key field (not to be confused with a keyword field) which uniquely identifies a document
f	Foreign key field (another document's key field value)
<none>	None of the above

TABLE 12

Example Purpose identifiers in accordance with this system include: "dtx_t_PhoneNumber" for a computed-for-display field; "vnam_CurrentAuthor := nam_DocAuthor" for a local variable in an @Formula being set to the value of a field on the current document; and "ktx_t_EmployeeSSN" for a field containing a unique identifier for the document.

The second component for a field name is the Data Type prefix. Data Type prefixes preferably conform to the scheme set forth in **Table 13** below.

Data Type Identifier	Comment
txt	Text field
tim	Date/time field
num	Number field
sec	Section field
aut	Author Names field
rdr	Reader Names field
nam	Names field
rtf	Rich-text field
html	Text field containing an HTML string (Hypertext Mark-up Language)
HTTP HTTPS	Text field corresponding to a CGI variable (Common Gateway Interface)
url	Field that contains a World Wide Web URL (Uniform Resource Locator)
yn	Field that has either a "Yes" or a "No" value
f	Numeric field that has a Boolean value of either @True or @False. "f" stands for "flag."
unid	Text field that contains a Notes Document Unique ID (@DocumentUniqueID)
list (obsolete)	A multi-value text field. The current standard uses a lowercase "l" before the datatype prefix to indicate multi-value fields instead of this obsolete prefix.
nid	Text field that contains a Note ID (@NoteID)

TABLE 13

Example Data Type prefixes in accordance with these rules include:
 "num_EditCounter", "tim_Created", "html_AppletTag", "rtf_Body", and
 "HTTP_HOSTNAME".

Object Identifier fields may be used to detect the presence of an object within a document. For example, if an object designated as "IIO0033 Expiration" is used on a form, documents created with that form will contain a field named "IIO0033." The Expiration agent, or any other object in the application, can then detect such documents using a selection formula such as "SELECT @IsAvailable(IIO0033)".

Object Identifier fields preferably consist of an object ID and an optional descriptive label in the format:

< object ID >

or,

< object ID > _ < label >

In a preferred embodiment, Object Identifier fields are always text fields, and are usually computed-when-composed. Any object that includes either a form or a subform should include an object identifier field, typically placed at the top of the form or subform. Since complex objects may consist of several types of documents, an object may have more than one object identifier field.

With respect to Script variables, there are generally two types: (1) Variables of fundamental data types, such as Integer, Double, String, Lists, Arrays and user-defined types; and (2) Variables that refer to an instance of a class, i.e., an object variable declared to be a NotesDocument, NotesDatabase, or some other class.

Names for fundamental data type scripts are preferably constructed as follows:

< scope/parameter type > < aggregate type > < data type prefix > _ < variable name > { suffix } ,

while names for instance variables are constructed as:

< scope/parameter type > < aggregate type > < class prefix > _ < variable name > { suffix } ,

or, in an abbreviated form:

< scope/parameter type > < aggregate type > < class prefix > { _ suffix }.

Script components preferably conform to the guidelines set forth in Table 14.

Component	Number of Characters	Description
<scope/parameter type>	Zero or One	<p>"Scope" is the visibility of the variable in a function/procedure. For example, variables may be defined locally or globally.</p> <p>Using a prefix for scope is especially important in LotusScript where the global module is well hidden, as one might wonder where specific variables have been declared.</p> <p>"<parameter type>" refers to how a parameter appears in a function or subroutine; either "by reference" or "by value." The distinction is important because changes to a "by reference" parameter can have inadvertent side-effects beyond the scope of a given function.</p>
<aggregate type>	Zero or One	Used to identify variables of the built-in "Aggregate" data types: arrays and lists.
<data type prefix>	One to Four	<p>Indicates the fundamental type of the variable. In addition to the basic data types like String and Integer, the system may define some extra prefixes for convenient types.</p> <p>Preferably never used in conjunction with a <class prefix>.</p>
<class prefix>	Three to Six	Indicates the class to which an object variable belongs. Some user-defined classes may specify a <class prefix> to use for instances of that class, but it is not required. If no class prefix is defined for objects of a given class, the "obj" prefix should be used instead. Preferably never used in conjunction with a <data type prefix>.
Underscore	One	For readability, the underscore character comes between the data type or class prefix and the descriptive name.
<variable name>	Variable, up to the limit for Script variable names	The descriptive name of the variable. Preferably use mixed case with initial capitals on distinct words. The variable name can be omitted if it is clear that there is only one possible instance of a variable of that type.
{suffix}	Variable	Optional, but quite convenient to use for naming variables.

TABLE 14

Scope/Parameter Types preferably conform to the guidelines set forth in Tables 15 and 16 below.

Scope	Comment
g	Global variable that has been declared in a "Globals" section
m	Module level variable that has been declared in the "Declarations" section of a form, button, agent, etc.
<none>	Local non-parameter variable declared in function/procedure

TABLE 15

Parameter Types	Comment
r	Variable is a reference parameter in a function/procedure. Reference parameters return their values to the calling function/procedure. This is the default in LotusScript.
v	A "ByVal" parameter to a function/procedure. Value parameters do not return their values to the calling function/procedure.

TABLE 16

Aggregate Types preferably conform to the guidelines set forth in Table 17 below.

Special Type	Comment
a	Variable is an array
l	Variable is a list (NOTE: Lotus Script lists are different from Notes multi-value list fields, though both use the lower case "L" character in their names.)
<none>	Variable is a single variable

TABLE 17

Data Type prefixes, Object Class prefixes, and Suffix prefixes preferably conform to guidelines set forth in Tables 18, 19, and 20 below.

Data Type	Comment	
dbl	Double precision floating point number	
sng	Single precision floating point number	
cur	Currency	
lng	Long integer	
int	Integer	
f	An Integer variable containing either True or False. "f" stands for "flag variable"	
var	Variant	
dat	Date/Time	
str	String	
typ	A variable whose type is a user-defined data type.	

TABLE 18

Object Class Prefixes	Comment
obj	Variables that are instances of user-defined classes, or of classes that do not have an associated class prefix. For example, "obj_AnalysisDoc" would indicate an instance of the user-defined class "class_AnalysisDoc".
5 nacl	NotesACL
nacle	NotesACL Entry
nagt	NotesAgent *
ndb	NotesDatabase *
ndt	NotesDateTime
10 ndir	NotesDbDirectory
ndoc	NotesDocument
ndtr	NotesDateRange
ncol	NotesDocumentCollection
neo	NotesEmbeddedObject
15 nfrm	NotesForm *
nintl	NotesInternational
nitm	NotesItem *
nlog	NotesLog
nnam	NotesName
20 nnews	NotesNewsletter
nreg	NotesRegistration
nrsty	NotesRichTextStyle
nrty	NotesRichTextItem *
nses	NotesSession
25 ntmr	NotesTimer
nuidb	NotesUIDatabase
nuidoc	NotesUIDocument
nuivw	NotesUIView
nuiwsp	NotesUIWorkspace
30 nvw	NotesView (It is preferable to name objects that have corresponding Notes element or field names by using the same descriptive name both in the Notes database and in Script).
nvcol	NotesViewColumn
oconn	ODBCConnection
oqry	ODBCQuery
ores	ODBCResultSet

Data Type	Comment
Cur	Current element (e.g. of array, result set, list etc.)
First	First element
Last	Last element
Next	Next element
Prev	Previous element
Min	Lower limit of range (e.g. of an array)
Max	Upper limit of range
Src	Source (e.g. of copy operation)
Dest	Destination
Old	Old element
New	New element
Temp	Temporary element

TABLE 20

Example script variable names in accordance with these guidelines include: "gdat_Actual" for a global date/time variable; "ndoc_Cur" for a "current" document in a loop; "Istr_CustomerIDs" for a list of strings; and "gatyp_MyArray()" for a global array of a user-defined type.

A LotusScript constant name is preferably constructed as:

<scope> <data type prefix> _<CONSTANT NAME>

wherein the name components conform to the standards set forth in Table 21 below.

Component	Description
<scope>	"g" for global, "m" for module, or omitted for local constants
<data type prefix>	One of the data type prefixes defined for Script variables.
<CONSTANT NAME>	Description of the constant name. Use all capital letters, with distinct words separated by underscores.

TABLE 21

Example constant names include: "gnum_HOLIDAYS_PER_YEAR" for a global numeric constant; and "str_JANUARY" for a string constant named "January". Similarly, user defined type names are preferably constructed as:

type_<type name> , and

- 5 class names are preferably constructed as:

class_<class name> .

Functions are also preferably given data type prefixes to reflect the type of value the function returns, i.e.:

<data type prefix>_<function name> ,

- 10 wherein the data type prefixes for function names are identical to those for script variables set forth above (for example: Function int_DaysBetweenDates(rdat_First as Variant, rdat_Last as Variant) As Integer).

Architectural Standards

As mentioned briefly above, a system in accordance with the present invention

- 15 provides and enforces a set of advantageous architectural standards which are imposed on the development process, thereby affecting the larger goal of providing object-oriented functionality in the context of a non-object-oriented software environment. Architectural standards relate to, among other things, framework or "kernel" objects and design elements which are required in all or most applications.
- 20 Architectural standards are preferably documented and communicated graphically via an object modeling technique (OMT). In the present context, an OMT (for example, the Unified Model Language, or UML) is a technique for representing design elements and the relationships between those elements in a concise graphical format. The OMT diagrams can be thought of as "blueprints" for the objects.
- 25 Referring now to Figure 10, OMT notation involves the use of bi-level boxes to represent design elements, wherein the top box (e.g., 1001) includes the name of the element, and the bottom box (e.g., 1003) sets forth various attributes of the element, if appropriate. Boxes that do not include a design element name are referred to as "abstract," and represent either other objects, groups of elements, interfaces,
- 30 or non-implemented (virtual) base classes. Relationships between objects are

designated by lines (e.g., 1005), which may or may not have an associated descriptive label. The nature of the relationship between two elements is denoted by the use of particular symbols at one or more endpoints of the line. More particularly, with continued reference to the graphical conventions shown in **Figure 10**, a

- 5 one-to-one association (1002) indicates that element A is associated with exactly one B; a zero-or-more association (1004) indicates that A is associated with zero or more Bs; a one-or-more association (1006) indicates that A is associated with one or more Bs; a Zero-or-one association (1008) indicates that A is associated with zero or one Bs; a "Has a" relationship (1010) indicates that A comprises a B and a C (e.g., where
10 A is a form, and B and C are subforms); and an "Is a" relationship (1012) indicates that B is an A and C is an A (potentially used with forms and subforms).

- Object Model diagrams, which comprise part of an object's documentation, are suitably used by the developer to determine the design elements contained in a given object. That is, all objects and applications are preferably created within a particular
15 template of required fields, required objects, and required roles. Moreover, objects are created in accordance with a preferred element order (e.g., subform order). Each of these architectural aspects will now be described in turn.

- On a large scale, all applications preferably conform to a structure which will best exploit an object-oriented methodology when used in the context of the various
20 components of the present system. In a preferred embodiment, for example, all applications conform to the system-level object model set forth in **Figure 11**. Specifically, an application (or database) 1102 "has a" Configuration object 1104, All View object 1106, and Standard View Template 1108. Application 1102 also has one or more form objects 1110, wherein form object 1110 is a Response Form 1130,
25 and has: zero or one Return objects 1120; zero or one Edit History objects 1122; zero or one Standard Action Buttons objects 1124; a Document ACL object 1126; and a Standard Subforms object 1128.

- Configuration object 1104 preferably provides the standard configuration and setup mechanism for applications. It's main purpose is to allow developers to easily
30 expose configuration controls to users, and to do so in a standard, modular way. Configuration object 1104 preferably comprises objects for storing configuration

settings related to the application as well as choices shown to users in keyword fields. Configuration object 1104 also preferably comprises a standard database configuration subform containing common settings, views for accessing configuration documents, and support for roles which control author access to documents.

- 5 All view object 1106 preferably provides a standard view for examining all documents in a database. This can be used by a user or developer for debugging purposes, or can be used in conjunction with script or HTML commands (e.g., LotusScript or Domino URLs) for programming purposes.

- Standard View Template 1108 preferably comprises forms and action buttons
10 designed to give a standard look and feel for all the views and search results pages in an application. This is particularly desirable in cases where the subject application is accessible to web clients.

- Return object 1120 is preferably used to provide a return field to objects which call the form. The return field -- which may concatenate information received from
15 multiple objects in a form -- may comprise information related to HTML code, an URL, a link back to the current document, or even background color of the returned page.

- Edit History object 1122 is preferably used to retain a chronological list of editors for the particular document. In a preferred embodiment, Edit History object 1122 stores the edit history in a single field rather than a plurality of fields; this
20 scheme eases the addition of new entries, provides flexibility with respect to the edit history data structure, and helps control disk space use.

- Standard Action Buttons object 1124 preferably comprises a subform containing a number of common action buttons, for example, "Save", "Close", "Edit", "Delete", "Previous/Next", and E-mail feedback. The use of such a subform helps
25 provide consistency across documents and across applications.

- Document ACL object 1126 provides standardized control over Reader and Author fields needed in an object-oriented application. This object preferably accepts input from other objects and grants author access to all documents in accordance with specified access conditions (e.g., through the use of a standard role. Among
30 other things, Document ACL object 1126 simplifies the task of troubleshooting with respect to access control problems.

Standard Subforms object 1128 preferably comprises a set of standard subforms, for example, a standard header subform (including a unique document ID, an author code, modification dates, and the like) and a standard footer subform.

In addition to required objects, development standards might include one or more required fields. Such fields might be used, for example, to communicate information to the user. In an illustrated embodiment, two fields are required for all applications: txt_DocSummary and txt_ResponseLine. The txt_DocSummary field suitably contains a one line summary of the document contents. Agents and views can use this field to describe the document to the user. The txt_ResponseLine field is suitably used on all response documents. It should contain a one line summary of the content of the response document. This field is used by views in response only columns.

Architectural standards might also specify the order of elements that appear in an object, particularly when a form comprises one or more subforms. For example, with reference to the various elements described above in connection with Figure 11, the following order of elements is suitable:

1. Standard Document Header subform
2. Standard Document Action Buttons
3. <Form-Specific elements>
4. Horizontal Divider element
5. Document ACL object
6. Edit History object
7. Standard Document Footer
8. Return object

In addition to required objects and required fields, a set of required roles may be specified. For example, in an illustrated embodiment, roles designated as "EditAll", "DBConfig", and "Keyword Config" are required. The "EditAll" role is suitably used in conjunction with Document ACL object 1126 to grant editor and reader rights to all documents in the database. The "DbConfig" role is suitably used to grant database-level rights to the application, and is advantageously used by any object that needs to restrict access to users who are owners or configurers of the

application. The "Keyword Config" role is suitably used to grant keyword setup rights to the application. The latter two roles are preferably assigned to users at the discretion of the developer/administrator/owner of the application.

Although the invention has been described herein in conjunction with the
5 appended drawings, those skilled in the art will appreciate that the scope of the invention is not so limited. Modifications in the selection, design, and arrangement of the various components and steps discussed herein may be made without departing from the scope of the claims.

CLAIMS

1. A method for using a programmable digital computer to create object-oriented applications within a non-object-oriented software environment implemented on said programmable digital computer, wherein said non-object-oriented software environment is configured to allow creation of an application comprising one or more design elements, said method comprising the steps of:

creating, in accordance with a predetermined set of design standards, an object within said non-object-oriented software environment, wherein:

10 said object comprises at least one of said design elements;

 said object is characterized by inbound public interfaces, outbound interfaces, and dependencies implemented using said design elements;

15 transferring said object to said application;
 determining, for said object, a level of compliance to said predetermined set of design standards.

2. The method of claim 1, wherein said predetermined set of design standards comprises naming standards and architectural standards.

3. The method of claim 2, wherein said object has an object name associated therewith, and said naming standards specify that said name of said object comprises an element prefix, an object ID, and an element name.

4. The method of claim 3, wherein said naming standards specify that said name of said object further comprises an instance number.

5. The method of claim 2, wherein said architectural standards comprise a graphical representation of said design elements configured in accordance with an object modeling technique.

6. The method of claim 2, wherein said architectural standards specify an order in which said design elements should appear in said object.

7. The method of claim 2, wherein said architectural standards specify a set of required design elements for said object.

8. A system for developing an object-oriented application within a non-object-oriented software environment provided on a digital computer, said system

10 comprising:

at least one object repository for storing objects;

an application builder configured to allow transfer of said objects from said object repository to said object-oriented application;

an application analyzer for analyzing said object-oriented application and

15 determining a level of compliance to a predetermined set of design standards.

9. The system of claim 8, further comprising at least one carrier database, wherein said application builder is further configured to allow transfer of said objects from said carrier database to said repository.

10. The system of claim 9, further comprising a code fragment library.

20 11. The system of claim 8, wherein said predetermined set of design standards comprises naming standards and architectural standards associated with said objects.

12. The system of claim 11, wherein each of said objects have an object name associated therewith, and said naming standards specify that said object name comprises an element prefix, an object ID, and an element name.

13. The system of claim 12, wherein said naming standards specify that said
5 object name further comprises an instance number.

14. The system of claim 11, wherein said architectural standards comprise a graphical representation of said objects configured in accordance with an object modeling technique.

15. The system of claim 11, wherein said architectural standards specify an
10 order in which said design elements should appear in said object.

16. The method of claim 11, wherein said architectural standards specify a set of required design elements for said objects.

1/10

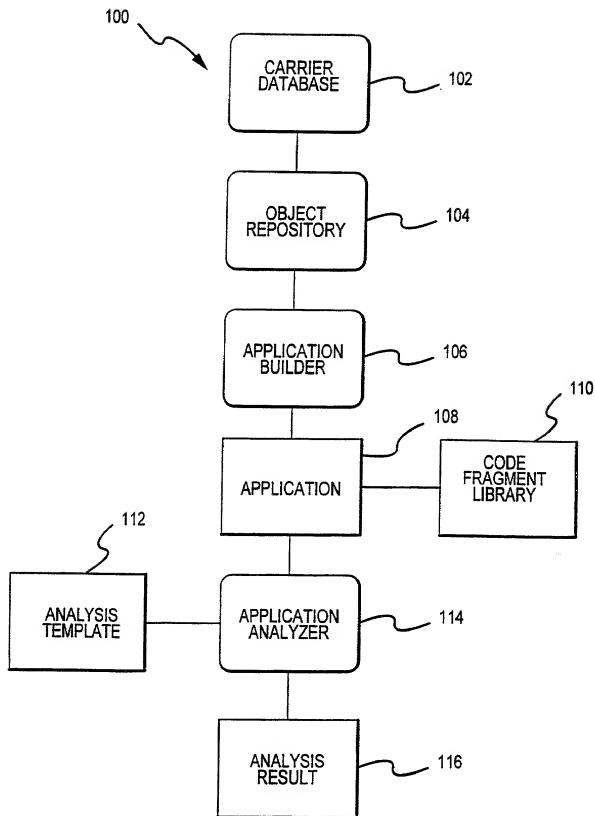


FIG.1

2/10

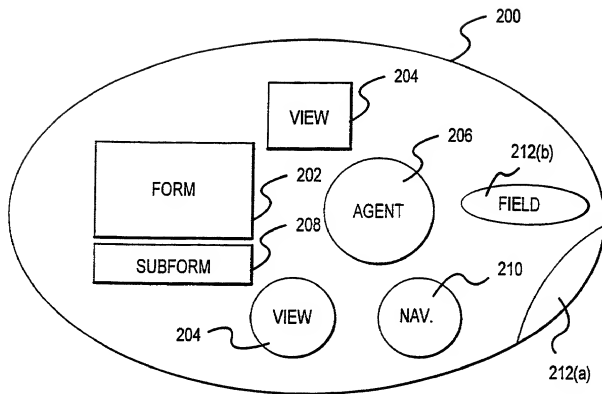


FIG.2

3/10

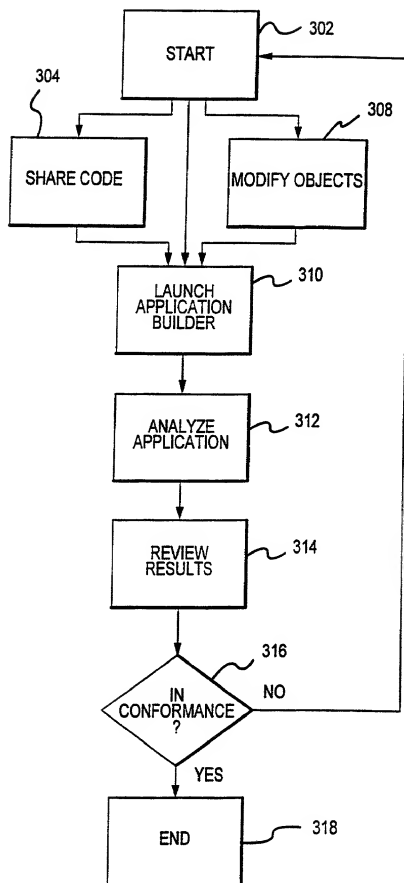


FIG.3

4/10

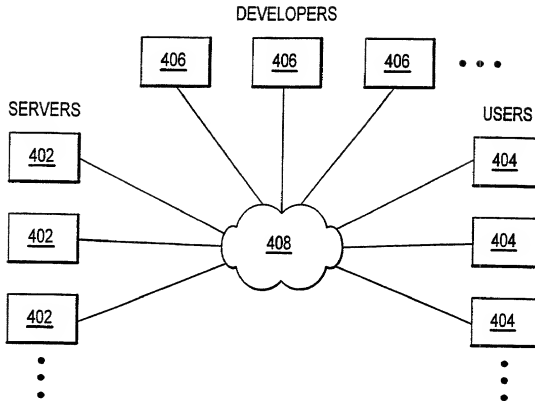


FIG.4

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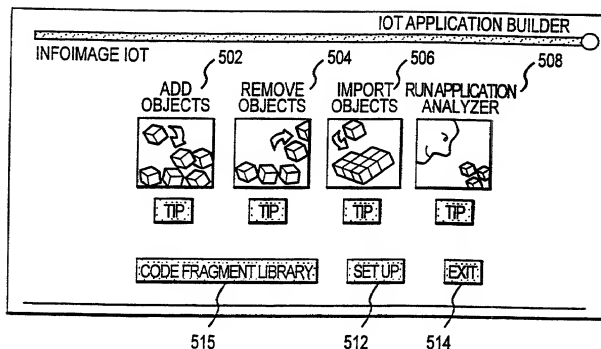


FIG. 5

602 {

▼ 1. SELECT APPLICATION

DATABASE LOCATION

SERVER NAME (LEAVE BLANK FOR LOCAL)

PATH AND DATABASE NAME ☐ BROWSE LOCAL

604 {

▼ 2. SELECT OBJECTS TO ADD

☐ (OPTIONAL) SHOW OBJECTS ALREADY IN APPLICATION TIP

CHOOSE OBJECT TYPE(S)

☐ ARCHIVED INFOIMAGE OBJECTS ☐ REQUIRED INFOIMAGE OBJECTS

☐ INFOIMAGE OBJECTS ☐ SAMPLE INFOIMAGE OBJECTS

☐ RECOMMENDED INFOIMAGE OBJECTS

606 {

▼ 3. ADD OBJECTS TO APPLICATION

ADD NOW ☐ (YOU MUST CLOSE AND REOPEN THE APPLICATION IN ORDER TO SEE THE ADDED DESIGN ELEMENTS.)

☒ INCLUDE DEPENDENCIES TIP

☒ INCLUDE OPTIONAL DESIGN ELEMENTS TIP

FIG. 6

6/10

REMOVE OBJECTS

INFOIMAGE IOT

☐ EXPAND ALL ☐ COLLAPSE ALL

702 { ▾ 1. SELECT APPLICATION

APPLICATION LOCATION

SERVER NAME ☐ (LEAVE BLANK FOR LOCAL)

PATH AND FILE NAME ☐ MyApp.NSF ☐ BROWSE LOCAL

704 { ▾ 2. SELECT OBJECTS TO REMOVE

☐ SHOW OBJECTS ALREADY IN APPLICATION TIP

☐ SELECT ALL ☐ DESELECT ALL

0030 WORKFLOW 0031 EXPIRATION & ARCHIVING 0033 EDIT HISTORY 0034 STANDARD SUBFORMS 0036 STANDARD ACTION BUTTONS 0037 \$\$RETURN 0041 REFERENTIAL INTEGRITY 0042 MAIL NOTIFICATION	<input type="button" value="->>"/> <input type="button" value="<<-"/> <input type="button" value="CLEAR"/>	
--	--	--

706 { ▾ 3. REMOVE OBJECTS FROM APPLICATION

☐ REMOVE NOW TIP

708 { ▾ 4. REVIEW LOG

FIG.7

7/10

IMPORT NEW OBJECTS

INFOIMAGE IOT

☐ EXPAND ALL ☐ COLLAPSE ALL

802	▼ 1. SELECT OBJECT CARRIER DATABASE DATABASE TO IMPORT FROM TIP SERVER NAME <input type="text"/> (LEAVE BLANK FOR LOCAL) PATH AND FILE NAME <input type="text"/> Carrier.NSF <input type="checkbox"/> BROWSE LOCAL
804	▼ 2. SELECT REPOSITORY REPOSITORY TO IMPORT TO TIP SEVER NAME <input checked="" type="radio"/> SAME SERVER AS APPLICATION BUILDER <input type="radio"/> LOCAL <input type="radio"/> DIFFERENT SERVER PATH <input checked="" type="radio"/> SAME PATH AS APPLICATION BUILDER <input type="radio"/> DIFFERENT PATH FILE NAME <input type="text"/> 110Rep.NSF
806	▼ 3. SPECIFY USER GUIDE LOCATION SEVER NAME <input checked="" type="radio"/> SAME SERVER AS APPLICATION BUILDER <input type="radio"/> LOCAL <input type="radio"/> DIFFERENT SERVER PATH <input checked="" type="radio"/> SAME PATH AS APPLICATION BUILDER <input type="radio"/> DIFFERENT PATH FILE NAME <input type="text"/> 110Doc.NSF
808	▼ 4. CHOOSE OBJECT TYPES OBJECT TYPE(S) TIP <input type="checkbox"/> ARCHIVED INFOIMAGE OBJECTS <input type="checkbox"/> REQUIRED INFOIMAGE OBJECTS <input type="checkbox"/> INFOIMAGE OBJECTS <input type="checkbox"/> SAMPLE INFOIMAGE OBJECTS <input type="checkbox"/> RECOMMENDED INFOIMAGE OBJECTS
810	▼ 5. IMPORT THE OBJECT IMPORT OBJECTS NOW <input type="checkbox"/>
812	▼ 6. REVIEW LOG

FIG.8

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RUN APPLICATION ANALYZER

INFOIMAGE IOT

☐ EXPAND ALL ☐ COLLAPSE ALL

902 { ▼ 1. SELECT APPLICATION TO ANALYZE

APPLICATION LOCATION

SERVER NAME ☐ (LEAVE BLANK FOR LOCAL)

PATH AND FILE NAME ☐ C:\notes\data\journal.nsf ☐ BROWSE LOCAL

904 { ▼ 2. SELECT ANALYSIS FILE

ANALYSIS FILE LOCATION

SEVER NAME ☐ (LEAVE BLANK FOR LOCAL)

PATH AND FILE NAME ☐ MyAnalysis.NSF ☐ BROWSE LOCAL

906 { ▼ 3. ANALYZE

☐ RUN APPLICATION ANALYZER TIP

☐ INCREMENTAL ANALYSIS TIP

☒ CHECK OBJECTS

FIG.9

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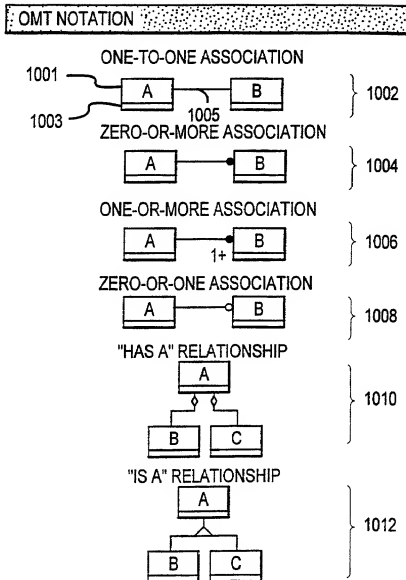


FIG.10

10/10

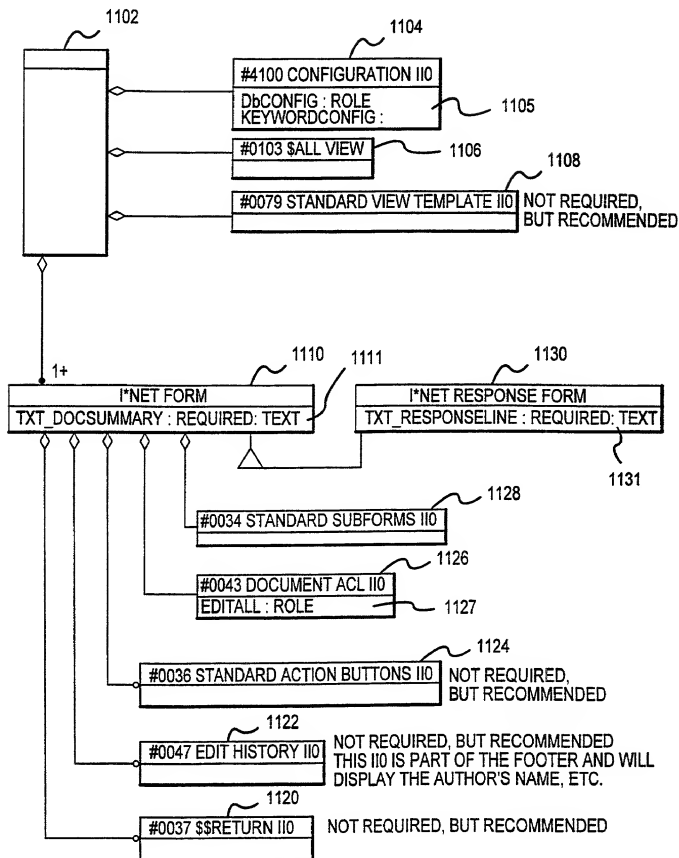


FIG. 11

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63) <input type="checkbox"/> Declaration Submitted with Initial Filing OR <input checked="" type="checkbox"/> Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16(e)) required)	Attorney Docket Number	32643.0293
	First Named Inventor	AANNESTAD, Bjorn
	COMPLETE IF KNOWN	
	Application Number	/
	Filing Date	
	Group Art Unit	
	Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHODS AND APPARATUS FOR NETWORK APPLICATIONS USING OBJECT TOOLS

the specification of which (Title of the Invention)

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 03/26/1999 as United States Application Number or PCT International

Application Number PCT/US99/06126 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above:

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
			<input type="checkbox"/>	YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below:

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.
60/079,611	03/27/1998	

[Page 1 of 2]

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DECLARATION ---- Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
PCT/US99/06126	03/26/1999	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transmit all business in the Patent and Trademark Office connected therewith: ☒ Customer Number 020322 

☐ OR Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner information sheet PTO/SB/02C attached hereto.

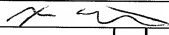
Direct all correspondence to: ☒ Customer Number or Bar Code Label 020322 ☐ OR ☐ Correspondence address below

Name	Daniel R. Pote, Esq.				
Address	Snell & Wilmer, L.L.P.				
Address	One Arizona Center				
City	Phoenix	State	AZ	ZIP	85004-2202
Country	US	Telephone	602-382-6325	Fax	602-382-6070

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))	Bjorn	Family Name or Surname	AANNESTAD
--	-------	------------------------	-----------

Inventor's Signature				Date	10/21/00
Residence: City	Tempe	State	AZ	Country	US
Post Office Address	228 East Fremont				
Post Office Address	A2				
City	Tempe	State	Arizona	ZIP	85282
Country	US				

☐ Additional inventors are being named on the supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached

Please type a plus sign (+) inside this box → ☐

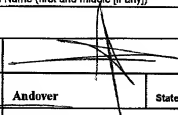
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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet
Page 1 of 1

Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
John		STACK	
Inventor's Signature			Date 2/6/01
Residence: City	Andover	State	MA Country US Citizenship US
Post Office Address	59 Birch Road MD		
Post Office Address			
City	Andover	State	MA ZIP 01810 Country US
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature			Date
Residence: City		State	Country Citizenship
Post Office Address			
Post Office Address			
City		State	ZIP Country
Name of Additional Joint Inventor, if any:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature			Date
Residence: City		State	Country Citizenship
Post Office Address			
Post Office Address			
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